

P E T I T I O N

To the Commissioner of Patents and Trademarks  
Washington, D.C. 20231

Your Petitioner, JONATHAN LEE SULLIVAN, a citizen of the United States and a resident of the State of Nebraska, whose post office address is 3762 Mohawk Street, Lincoln, Nebraska 68510, prays that Letters Patent may be granted to him for the improvement in

AN ANTENNA SYSTEM FOR A  
WIRELESS COMMUNICATION DEVICE

as set forth in the following specification.

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

This invention relates to an antenna system for a wireless communication device and more particularly to a combination internal/external antenna for a wireless communication device such as a cellular telephone.

2. DESCRIPTION OF THE RELATED ART

Internal antennas have been previously used in the interior of a wireless communication device housing or as an internal part of the housing itself. Internal antennas for portable wireless communication devices are becoming very popular in wireless design. Manufacturers are being encouraged to develop and install internal antennas in wireless devices inasmuch as internal antennas are becoming appealing to the user. First, the aesthetics of the handset is perhaps the biggest reason that internal antennas are gaining popularity. Much effort is put into the styling of cellular handsets and an antenna mounted on the outside of the housing detracts from the aesthetic appearance of the device. Second, robustness of the handset is improved by placing the antenna inside the protective housing instead of having the antenna exposed on the

1 outside of the handset and extending therefrom. Third, due to the smaller overall size of  
the handset when an internal antenna is utilized, the handset is more convenient to  
stow away into pockets or purses when not in use. Fourth, in some instances, internal  
antennas may shield a portion of the radiated energy away from the user's head, which  
5 is important because more radiated energy is being transmitted as useful radio signals  
and less radiated energy is being absorbed by the user's body. One of the  
disadvantages of internal antennas is that in some cases they do not work well enough  
to receive or transmit a high quality radio signal as well as an external antenna.

#### SUMMARY OF THE INVENTION

10 A wireless communication device is disclosed comprising a housing having a  
transceiver circuit disposed within the housing. An internal antenna is disposed within  
the housing which is RF connected to the transceiver circuit. An external, retractable  
antenna is mounted on the housing and is selectively movable from a retracted position  
within the housing to an extended position. The external, retractable antenna is RF  
15 connected to the transceiver circuit. In most cases, a switching mechanism will be  
utilized in the device which operatively connects the internal and external antennas to  
the transceiver circuit so that the internal antenna is normally in circuit and wherein said  
external antenna is normally out of circuit when in its retracted position. The matching  
circuit switches the internal antenna out of circuit and switches the external antenna in  
20 circuit when the external antenna is in its extended position. Preferably, a remote, RF  
port is provided which is mechanically connected to the internal antenna.

It is a principal object of the invention to provide an antenna system designed  
primarily for cellular telephones, but which also can be utilized on other portable  
wireless devices.

1 It is a further object of the invention to provide an antenna system for a wireless communication device which comprises a primary internal antenna and a secondary retractable external antenna.

5 Still another object of the invention is to provide a dual antenna system for a wireless communication device with the dual antennas comprising an internal antenna and an external antenna.

10 Still another object of the invention is to provide a dual antenna system for a wireless communication device wherein if call reception becomes degraded while using the internal antenna, the user has the ability to extend the secondary antenna by pulling it to the extended position so that the RF performance of the device is improved.

It is a further object of the invention to provide a dual antenna system for a wireless communication device which does not detract from the aesthetic appearance of the handset.

15 Still another object of the invention is to provide a dual antenna system for a wireless communication device which enables the device to have good performance, but which does not occupy a large amount of space.

These and other objects will be apparent to those skilled in the art.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of a cellular telephone handset;

20 Figure 2 is a back perspective view of a combination internal and external antenna for use with a cellular telephone handset of Figure 1; and

Figure 3 is an exploded perspective view of the handset having the combination internal/external antenna incorporated therein.

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1 DESCRIPTION OF THE PREFERRED EMBODIMENT

2 The numeral 10 refers to a conventional wireless communication device such as  
3 a cellular telephone handset. Handset 10 includes a conventional front housing 12,  
4 back housing 14 and a printed circuit board 16 which functions as the transceiver circuit.  
5 Back housing 14 is preferably provided with an opening 17 which communicates with a  
6 remote RF port 18 which is mechanically connected to the internal antenna 20. The  
7 remote RF port 18 may be fabricated as a separate component and attached to the  
8 internal antenna 20 or may be insert-molded into the internal antenna. Further, RF port  
9 18 may be incorporated as one piece into the internal antenna 20. (Figure 3)

10 Internal antenna 20 is provided or mounted in the interior of the handset 10 and  
11 may be constructed using conventional methods and the methods of the prior art. Two  
12 common methods of fabricating these types of antennas are to first mold the antennas  
13 from a plastic material and then selectively plate metal thereon. The internal antenna  
14 20 is the primary antenna of this invention and may be designed as a PIFA, meander  
15 line, micro-strip patch or any other antenna design that will meet the electrical and  
16 mechanical requirements of the system.

17 The numeral 22 refers to a conventional retractable antenna which is selectively  
18 movable between the retracted and extended positions in conventional fashion. When  
19 the antenna 22 is in its retracted position of Figure 1, only the upper end of the antenna  
20 is exposed so as not to detract from the aesthetics of the handset. The external  
21 antenna 22 is commonly referred to as a whip antenna and may be constructed using  
22 various existing electromechanical designs such as top loaded, bottom loaded, etc.

23 In some cases, an antenna switching device will be utilized to electrically connect  
24 one antenna to the transceiver circuit while disconnecting the second antenna from the  
25 transceiver circuit. For example, when the external retractable antenna 22 is extended,

(Figure 3)

the antenna feed circuit is connected. When the external retractable antenna 22 is retracted, it is disconnected from the antenna feed circuitry and the internal antenna 20 is connected. The internal antenna 20 functions as the primary antenna while the retractable antenna 22 functions as a secondary antenna. The antenna system may operate in a single frequency or it may be made to operate in several frequency bands at once.

The internal antenna 20 will normally work well enough to receive and send a radio signal most of the time. When the radio signal fades and becomes weak, the secondary antenna 22 may be extended. The "back-up" secondary antenna 22 may be extended when needed and retracted into the handset when not in use.

Thus it can be seen that a novel antenna system has been provided for a wireless communication device which utilizes a primary internal antenna, but which may use a secondary retractable antenna should the need arise.

Thus it can be seen that the invention accomplishes at least all of its stated objectives.